STAT 5010: STATISTICAL METHODS II

Instructor Information

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Office Hours: In person: Before class **by appointment**.
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Course Description

Probability and statistics are essential tools for engineers, data scientists, and many other professionals. Statistics can be understood as the study and application of (1) methods for reliably gathering and presenting information (descriptive statistics), and (2) methods for drawing conclusions about the world from limited information (inferential statistics). In this course, we will be concerned with both (1) and (2). Especially for (2), we will need to learn how to analyze chance events. As such, we will study some probability theory during the first few weeks. Our ultimate goal is to use tools from mathematics to analyze sample data and try to make predictions or draw conclusions.

This course is specifically designed and taught for data science graduate students (DS-MS).

Textbook (Optional) & Software

The textbook is optional and you will not need to purchase it in order to succeed in this course. This course, unlike STAT5000, will use material from multiple textbooks and attempting to follow along in a text will be considerably more difficult. As of now, no assignments will rely on the textbook, but that may change. If it does, I will provide you with a personalized version of the assignment. However, the main text is a great resource and it may help you throughout the course. R programming language will be needed, along with R Studio. These are both available for Windows and iOS (and some Linux variants). I recommend that you have your own computer since this course relies heavily on programming assignments and frequent internet access. *Keep in mind:* Coding is all about PRACTICE. You need to do it in order to learn it.

You will also want access to a printer. The assignments will be submitted via Canvas.

Course Webpage

You should be automatically added to our Canvas course. This will be where I post assignments and announcements. If you have not been added, please *talk to me immediately about getting added to our Canvas course*!

Grading

The course grade is determined by the following components:

Exam 1	15%
Exam 2	15%
Homework	40%
Quizzes	15%
Project	15%
Final Exam [Currently no Final]	0%

As of now, this will be the foundation going forward. Subject to change. I will most likely weight the course, which will only help you.

Exams

Both midterms and the final exam will be in person during a scheduled class time. The midterm dates will be announced at the beginning of the semester. The final exam will be during finals week and the course should automatically get a date and time assignment from the university. If this doesn't happen, I will assign a date and time for the final exam. I may implement a take-home final if it fits the course well. I may also cancel the final exam and replace it with extra quizzes or more time/weight toward the final project.

There are NO make-up exams. If you miss an exam, you missed an exam. If you have a planned religious holiday or major event (medical, but others will be considered), you must tell me by the end of the first week of the course! This includes events that fall on non-exam dates because if you do not tell me and an exam must be moved, your event cannot be accounted for since I was never told about it and your reason will not be valid at that point in time.

Both exams have been placed on dates that do not correspond with any Office of Equality & Diversity Religious Holiday Observance days. If you have a planned serious medical event that falls on an exam date, you must tell me by the end of the first week of the course! Failure to notify me about exam conflicts by the end of the first week, for any conflict reason, will result in the original exam dates staying put. Valid exemptions will move the exam date for everyone.

Emergency medical procedures, testing positive for COVID, etc.. will require a special edition exam.

Homework

My homework policy is the most intricate part of the grading system so make sure you understand this entire section.

Homework will come with a theoretical section and a computational section. **HOMEWORK MUST BE EXTREMELY NEAT if hand-written.** For the theoretical section, feel free to neatly hand-write your solutions or type them up using your preferred method (LaTeX, Word, etc..). The computational section should always be done in R, with help from R Studio and R Markdown.

Homework will be submitted: Neatly written or typed, in question order, on the due date via Canvas. Anything hand-written must be scanned with a method that preserves quality. The computational section, which again should be done with R Studio and R Markdown, should clearly show your code and output.

This is a high-level graduate course that is designed to make you think and promote challenging ideas. In order to incentivize you to prioritize reflective thought and true understanding over a "better grade", homework will be carried out in a unique way:

Your homework will be self graded. For each question you turn in, grade yourself in the

following manner:

0 points for anything in the range of *no effort to little/some effort*, resulting in no coherent answer. 1 point for *a serious effort*, resulting in little/some part of a coherent answer. 2 points for *a serious effort*, resulting in a very coherent and complete answer, one that you are confident is mostly correct.

When you submit your homework, each question should be clearly self-graded (red pen, red text, etc..) and your entire homework should have your overall self-grade (add up each self-graded question score).

The key here is that if you end up getting all 1's on your homework (or an average homework score of 1), you will get an A for homework. This is a very lenient homework grading system where I trust you to provide honest grading on how much *effort* you put into the homework. If you spent an hour thinking about a question, tried some coding or math to figure it out, and showed what you did try while explaining your thought processes, yet you didn't really get a solid answer, *that is perfectly fine!* Give yourself a 1 for that question. A self-grade of a 1 should always come with some work, whether it is:

(1) an explanation of your thought process for the question, what you tried, etc..

(2) some code that wouldn't execute and you couldn't figure out why, what you think the problem might be with your code, etc..

(3) some mathematical approaches to the problem that didn't work out and some intuition behind your approach. do you know the correct approach but couldn't figure out the math? etc..

(4) or some combination of (1),(2),(3).

Besides you grading your own homework, we will have a Grader to grade homework. They will notify me if you receive too many 0's for homework question self-grades, and we will have to discuss why that is happening and try to get you back on track. They will also ensure that you do not abuse this system by keeping track of your homework self-grades and timeline, and if needed, their formal grading of your homework will be implemented. I reserve the right to formally grade your homework if I believe you are abusing my system. If this happens, you will be graded on a strict 0 or 2 grading scheme, where 2 is reserved for completely correct solutions and 0 for anything else.

All homework must be submitted on Canvas.

Late homework will not be accepted.

Homework will be the overwhelming time investment in this course. We will review everything about it in detail during the first class.

Attendance

This is a graduate course and you are all adults, presumably preparing for a career in data science. Attendance is your own decision and will not be reflected in your grade. Keep in mind that not attending means you could miss a quiz or details about the course, exams, etc.. and the consequences would be on you if that did happen.

Quizzes

Quizzes will be randomly given at the end of class and will be every week or two. Your lowest quiz will be dropped. This is meant to be used in an emergency when you have to miss class rarely and a quiz happens to be on that day.

Project

We will have a final project that will test your ability to analyze data. This will most likely be a project that you design from scratch based on your career and personal interests. We will spend some time discussing projects and pitching ideas to classmates and myself, and I will need to approve your project. You will need to make significant use of R, R Studio, R Markdown, and Tidyverse in order for your project to be considered a success. These will **NOT** be self-graded. They will need to be submitted on a specific due date and must include all code and output, **including an R Markdown PDF that summarizes the project and all code that went into making it happen**. By this time in the semester, you will already have a solid understanding of the expectations here. This is supposed to be a culmination of programming knowledge and Tidyverse application, but if you want it to be slightly more theoretical and less programming, or if you want to take a different approach in general, talk to me about your idea. This can also be a continuation or partial continuation of your STAT5000 project, assuming we review your project grade and it was a success.

Student-centric experience

If you think you may have a good idea, whether it has to do with grading, exams, programming, or really any topic, feel free to discuss with me during office hours or in class during the first class meeting. I'm usually open to changing around the course to fit the needs of the students, which may be more difficult if the class size is large, but I will certainly try.

Grade Scale

Grades will normally be curved and then split into large chunks based on large deviations in grade. These chunks will be graded from B (lowest) to A (highest). Grades below a B are uncommon and reserved for situations where minimal effort was given and little understanding of the subject matter was gained. If no chunks are obvious, and everyone does extremely well, I am fine giving an abundance of A's. This process (on top of lenient grading policies and helpful grading advantages) is overwhelmingly beneficial to the student when compared to cookie cutter grading schemes like A = 95+, B = 85-95, etc..

University Policies Below..

Below this section will be useful university policies. Please feel free to read them, as they are generally important to know.

1 Classroom Behavior

Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the policies on classroom behavior (https://www.colorado.edu/policies/student-classroom-course-related-

behavior) and the Student Conduct & Conflict Resolution policies (https://www.colorado.edu/sccr/student-conduct).

2 Requirements for COVID-19

As a matter of public health and safety due to the pandemic, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements and all public health orders in place to reduce the risk of spreading infectious disease. Students who fail to adhere to these requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution (https://www.colorado.edu/sccr/) and CU Boulder Police will be called. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus. As of Aug. 13, 2021, CU Boulder has returned to requiring masks in classrooms and laboratories regardless of vaccination status. This requirement is a temporary precaution during the delta surge to supplement CU Boulder's COVID-19 vaccine requirement. Exemptions include individuals who cannot medically tolerate a face covering, as well as those who are hearing-impaired or otherwise disabled or who are communicating with someone who is hearing-impaired or otherwise disabled and where the ability to see the mouth is essential to communication. If you qualify for a mask-related accommodation, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus. In addition, vaccinated instructional faculty who are engaged in an indoor instructional activity and are separated by at least 6 feet from the nearest person are exempt from wearing masks if they so choose. Students who have tested positive for COVID-19, have symptoms of COVID-19, or have had close contact with someone who has tested positive for or had symptoms of COVID-19 must stay home. In this class, if you are sick or quarantined, notify me immediately and stay home.

3 Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website (https://www.colorado.edu/disabilityservices/). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.

4 Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

5 Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code academic integrity policy. Violations of the Honor Code may include, but are not limited to: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the Honor Code website (https://www.colorado.edu/sccr/honor-code).

6 Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, **any religious observance that is not documented to me via official notification by the end of the first week of the course will not be factored into the exam date scheduling process**. See the campus policy regarding religious observances for full details (https://www.colorado.edu/policies/observance-religious-holidays-absences-classes-or-exams).

7 Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

The University of Colorado Boulder (CU Boulder) is committed to fostering an inclusive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, or protected-class discrimination or harassment by or against members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or email cureport@colorado.edu. Information about OIEC, university policies, reporting options (https://www.colorado.edu/oiec/reporting-resolutions/making-report), and the campus resources can be found on the OIEC website (https://www.colorado.edu/oiec/). Please know that faculty and graduate instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about their rights, support resources, and reporting options.